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# Working Trees for Agriculture

**WORKING TREES** help make agricultural systems more sustainable by protecting crops and livestock, conserving natural resources, improving human environments, and providing sources of income.



Putting trees to work in conservation and production systems for farms, ranches, and nearby communities means planting the right trees, in the right places, and in the correct design to achieve desired objectives.

Agroforestry is a unique land management approach for landowners and anyone who cares about working lands and natural resources.

Agroforestry practices provide opportunities to integrate productivity and profitability

with environmental stewardship and result in healthy and sustainable agricultural systems that can be passed on to future generations.

Agroforestry practices include field, farmstead, and livestock windbreaks; riparian forest buffers along waterways; silvopasture systems with trees and forage growing together for livestock grazing; alley cropping annual crops with high-value trees; forest farming operations where high-value specialty crops are grown under the protection of a

managed forest canopy; and a variety of special applications to help manage natural resource issues.

Within a landscape-scale management approach, agroforestry can help to reduce the zone of conflict between rural and urban land uses. Tree-based buffers serve as a zone of transition and help to "reconnect" agriculture and communities, creating a more functional and sustainable landscape.



# Economic

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## Diversify Income

Fluctuating markets, unpredictable weather patterns, and international competition are all a part of today's modern agricultural world. Diversification reduces risk and can make the difference between success and failure for a farming or ranching enterprise. Agroforestry can diversify farm and ranch income, increase crop yields, and conserve natural resources.

Valuable products harvested from agroforestry practices include: wood for energy generation, paper production, and landscaping chips; fruits and nuts; wood shavings for animal bedding material; Christmas trees; sawlogs for dimension lumber; high-value timber products such as furniture-quality wood and veneer logs; and specialty crops like decorative florals, mushrooms, herbs, medicinal plants, and craft materials.

# Social

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## Meet People's Needs

People and communities are an essential part of agricultural systems. Agroforestry addresses human needs by improving the quality of life. Agroforestry practices not only apply to rural farms, but to communities as well. In fact, agroforestry practices, like windbreaks and riparian forest buffers, are being put to work in and near communities to protect soil, water, wildlife, roads, and buildings.

Green space ranks among the top five things people seek when choosing a new place to live. When this includes *Working Trees*, the green space can reduce noise, block objectionable views, moderate odors, and filter dust.

## Conserve Energy

Agroforestry practices can significantly reduce energy use throughout the year. Heating costs can be cut by 10 to 25 percent in homes protected by windbreaks, especially in the high wind, low temperature regions of the United States. In areas where hot winds are common, windbreaks can reduce air conditioning demands. Living snowfences reduce the need for snow removal, thus saving fuel, while field windbreaks improve crop water-use efficiency thereby reducing irrigation costs.

## Enhance Productivity

Farm productivity and product quality can be increased substantially when agroforestry practices are utilized.

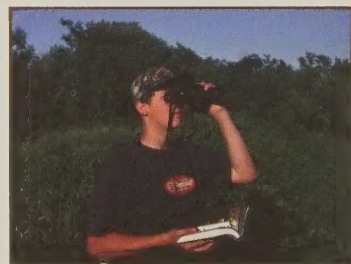
Windbreaks protect crops, livestock, and soil and water resources. In cold weather, livestock protected by trees exhibit improved weight gains of as much as 10 percent and require up to 50 percent less feed. Milk production has been shown to increase by eight to 20 percent. Windbreaks can greatly reduce or eliminate disastrous losses of newborn lambs and calves from blizzards.

In dry climates tree windbreaks can increase row-crop productivity by as much as 25 percent and hay yields by 60 to 80 percent. This is due to their ability to moderate the effects of hot, drying winds which increase evaporation and plant transpiration by crops.



## Aesthetics

Agroforestry practices generally add desirable variety that enhances the visual quality of the landscape. When designed properly, agroforestry practices can also provide more comfortable working environments by screening undesirable views, odors, and noise; reducing wind speed; and providing opportunities for viewing wildlife.







Incorporating *WORKING TREES* into the landscape will increase agricultural productivity, protect natural resources, provide new sources of income, and enhance environments for people and wildlife.



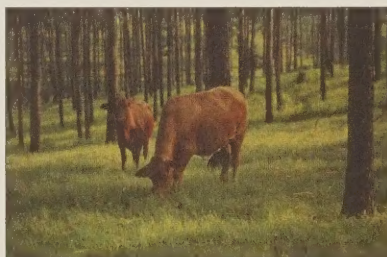
# Agroforestry Practices

Incorporating agroforestry practices can increase agricultural productivity, protect natural resources, provide new sources of income, and enhance environments for wildlife and people.



## A. Windbreaks

Windbreaks are rows of vegetation used to reduce and redirect wind. Field windbreaks improve crop yields and water-use efficiency, and reduce wind erosion. Livestock windbreaks help reduce climate stress on animals, feed consumption, and visual impacts. Farmstead windbreaks enhance living and working environments, add value to your home, and help conserve energy. Living snowfences keep roads clear of drifting snow and increase driving safety.



## B. Silvopasture

Silvopasture systems combine trees with forage and livestock production. In conifer stands the trees are managed for long-term, high-value sawlogs, while the understory is managed for forage production to support livestock grazing. In Christmas tree plantations, carefully managed grazing provides an alternative to mowing. Some nut and fruit orchards may also be grazed.



## C. Alley Cropping

In an alley cropping system, an agricultural crop is grown in the alleys between widely spaced rows of trees. The agricultural crop provides for an annual income while the trees produce a long-term income. Fine hardwoods like walnut, oak, ash, and pecan are favored species in alley cropping systems and are managed for high-value lumber or veneer logs. Nut crops can be another intermediate tree product.



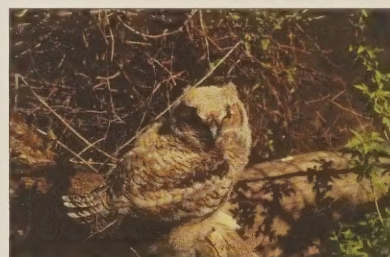
## D. Forest Farming

In forest farming, high-value specialty crops are cultivated under the protection of a forest canopy that has been modified to provide a desired amount of shade. Crops like ginseng, shiitake mushrooms, and decorative ferns are sold for medicinal, culinary, or ornamental uses. Forest farming provides an added income while trees are being grown for high-value wood products.



## E. Riparian Forest Buffers

Trees, shrubs, and grasses in riparian zones (those lands adjacent to streams, ponds, and wetlands) buffer water bodies from negative impacts from adjacent agricultural lands. Natural or re-established streamside forests provide ecological functions and reduce non-point source pollution of waterways, reduce bank erosion, and increase biodiversity.



## F. Special Applications

Tree and shrub plantings may be used to help solve special resource concerns. Some special applications include the utilization of wastewater or irrigation tailwater to produce a short rotation woody crop, and plantings to help stabilize streambanks and floodplains. Any agroforestry practice can be designed to enhance wildlife habitat and to optimize carbon storage.





# Environmental

## Air Quality

The leaves and branches of the tree and shrub canopy help filter and absorb air pollutants including dust particles and moisture droplets.

Tree canopies also create cooler temperatures resulting in reduced smog levels. Ongoing research suggests that trees and shrubs may help mitigate air quality impacts of livestock and industrial odors. Windbreaks can improve chemical spray efficiencies and reduce off-site spray drift.

A key consideration for rebalancing the global carbon cycle is to find ways to promote the increased growth of trees and shrubs. Trees store carbon dioxide in their wood as they grow and can contribute greatly to reducing atmospheric carbon dioxide levels.



## Water Quality

*Working Trees* protect water quality and safeguard clean water supplies for fish, wildlife, and people. Agroforestry practices, combined with other appropriate practices, create conservation buffer systems to control both point- and non-point source runoff from agricultural operations.

Trees and shrubs in riparian zones filter surface runoff laden with sediment, nutrient, chemical, and biological contaminants. Trees also help to stabilize streambanks by armoring banks against the force of flood waters. Tree and shrub roots absorb contaminants in shallow groundwater and also protect streambanks by holding soil particles together.

## Soil Quality

Sediment eroded from crop fields and construction sites carries unwanted pesticides and excess nutrients into ditches, streams and water supply reservoirs. Eroded soils are less productive due to loss of organic matter, nutrients, and soil structure.

Trees, shrubs, and other permanent vegetation in the landscape create stable areas that reduce or eliminate wind and water soil erosion. Windbreaks or alley cropping systems placed on contours within a field limit the distance water can move downhill, thereby reducing its velocity and erosive power. When these practices are placed perpendicular to erosive winds, the reduced wind energy results in less erosion.

## Plant Quality

The quality of plants grown in association with *Working Trees* is often improved. In orchards, vineyards and vegetable fields sheltered by trees, the produce has less bruising, scarring, and premature drop normally caused by wind. Pollination by insects is improved due to reduced winds. Trees and shrubs grown near crops and gardens can harbor birds and beneficial insects that feed on pest insects and mammals.



## Wildlife Habitat

Agroforestry practices can improve both terrestrial and aquatic habitat. Extensive agricultural activities often lead to a reduction in the amount or quality of wildlife habitat. Agroforestry offers a unique opportunity for improving habitat in agricultural landscapes.

Populations of many wildlife species often increase with the addition of trees and shrubs into agricultural areas. This increase provides opportunities for both hunting and recreational uses, such as birdwatching.





# Planning & Managing

When considering how or where to incorporate *Working Trees* into your production system, keep the following ideas in mind.

**Determine Objectives** — Before you design and install an agroforestry application, you have to know what you want it to accomplish. Initially, a landowner may have only a general idea of problems to solve or conditions to improve. This provides a starting point, but both a site- and a landscape-scale assessment should be conducted.

**Site Assessments** identify more clearly a landowner's initial ideas and verify his or her needs. They should also identify other conditions that could be improved by, or limit the effectiveness of, agroforestry at the site.

**Landscape Assessments** identify resource conditions and problems in the surrounding area that could affect, or be affected by, an agroforestry practice at the landowner's site. For example, a site might be within a critical breeding area for certain at-risk species of wildlife or drains to a stream that provides drinking water to a local community.

**Develop Alternatives and Select One** — Formulating a viable alternatives typically requires repeated design, evaluation, and refinement. A complete agroforestry design indicates its location, size, and vegetation composition, as well as how the practice should be managed. Professional judgement, environmental impacts, accepted rules-of-thumb, and scientific models can be used to estimate how well a design may achieve each planning objective.

**Implement and Monitor** — Small agroforestry projects can be installed with a minimum of planning, however, relatively large and more-complicated projects may require implementation planning to organize numerous activities, people, and equipment, particularly if installation is a long-term activity. After installing the selected design, monitor how well each of the planning objectives (and other criteria) are being met. Some objectives may not be achieved for several years. In these cases, regular monitoring can still help determine if there is satisfactory progress toward fulfilling the objectives.

**Revise as needed** — The planning process is a learning process for the planner and the landowner. New information often leads to better assessments of problems and limitations, changes in priority, and new or modified objectives. If monitoring suggests that the planning objectives are not going to be met, the plan can be revised and re-implemented. This kind of planning after the practice is installed is sometimes called "adaptive management."

## Where To Get More Information

For local assistance, contact your nearest USDA-NRCS office, County Extension Office, Soil and Water Conservation District, State Forestry Agency, or a local natural resource consultant.

For more information at the national level, contact the USDA National Agroforestry Center (NAC), East Campus-UNL, Lincoln, NE 68583-0822. Telephone 402-437-5178.



This brochure was developed by the USDA National Agroforestry Center (NAC).

**NAC's Mission:** The USDA National Agroforestry Center (NAC) is a partnership of the USDA Forest Service, Research & Development (Rocky Mountain Research Station) and State & Private Forestry and the USDA Natural Resources Conservation Service. NAC's purpose is to accelerate the development and application of agroforestry technologies to attain more economically, environmentally, and socially sustainable land-use systems. To accomplish its mission, NAC interacts with a national network of cooperators to conduct research, develop technologies and tools, establish demonstrations, and provide useful information to natural resource professionals.

**Address:** USDA National Agroforestry Center, East Campus - UNL, Lincoln, Nebraska 68583-0822. For a supply of brochures, contact Nancy Hammond at [nhammond@fs.fed.us](mailto:nhammond@fs.fed.us), or fax 402-437-5712. For more information on NAC, contact Rich Straight, 402-437-5178 ext. 24, [rstraight@fs.fed.us](mailto:rstraight@fs.fed.us) or Bruce Wight, ext. 36, [bwight@po.nrcs.usda.gov](mailto:bwight@po.nrcs.usda.gov).

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